

Status of CBP Decision Options for Model Analysis Supporting the 2017 Midpoint Assessment

**Scientific and Technical Advisory Committee
September Quarterly Meeting**

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Background

A system of models developed for the 2017 Midpoint Assessment will be applied to the last and most difficult reductions in the CBP WIPlls, which will be implemented from 2017 to 2025.

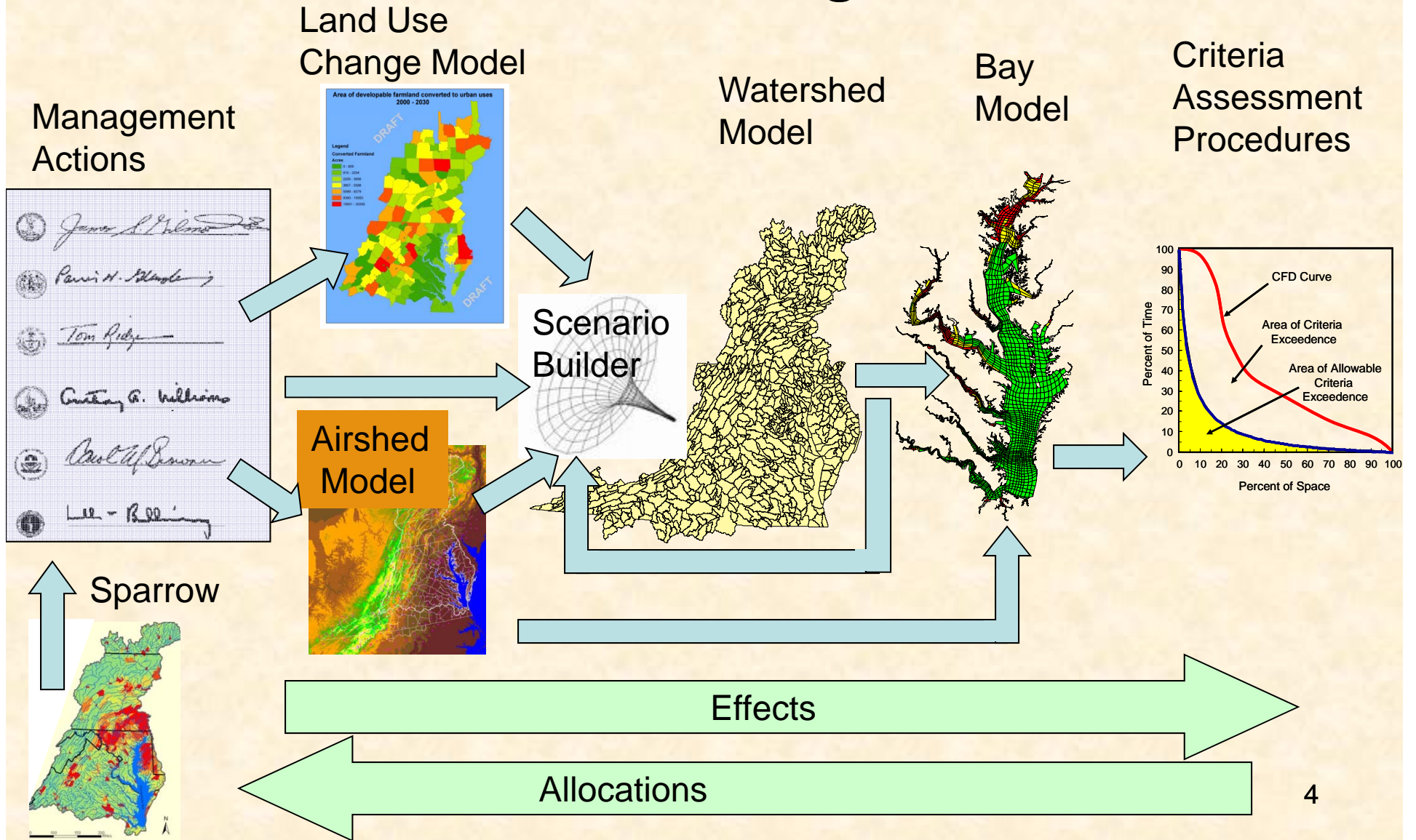
Any CBP model refinements addressing the 2017 Midpoint Assessment will be assessed on a *value added* basis for CBP decision making. The CBP Partners are beginning the process of 2017 refinement prioritization.



Key Points

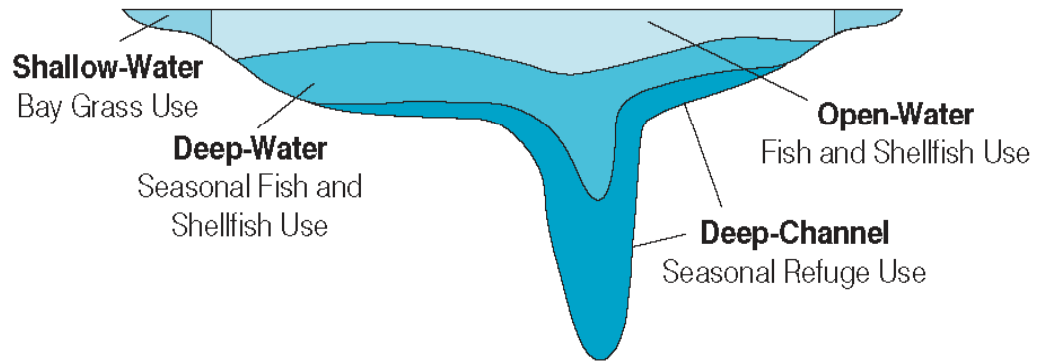
- The CBP models guiding TMDL planning and implementation are well founded and fully suited to their current task.
- Nevertheless, over the last quarter century, the CBP has been committed to refinement of our watershed, estuary, and airshed analysis tools to improve CBP decision making and is now interested in examining the value of Multiple Management Models (M3) in the shallow waters of the Chesapeake Bay.
- Refinement of the CBP modeling tools over the past 3 decades have always been oriented to value added development of the best available scientific tools for use by CBP decision makers.

Chesapeake Bay Program Modeling

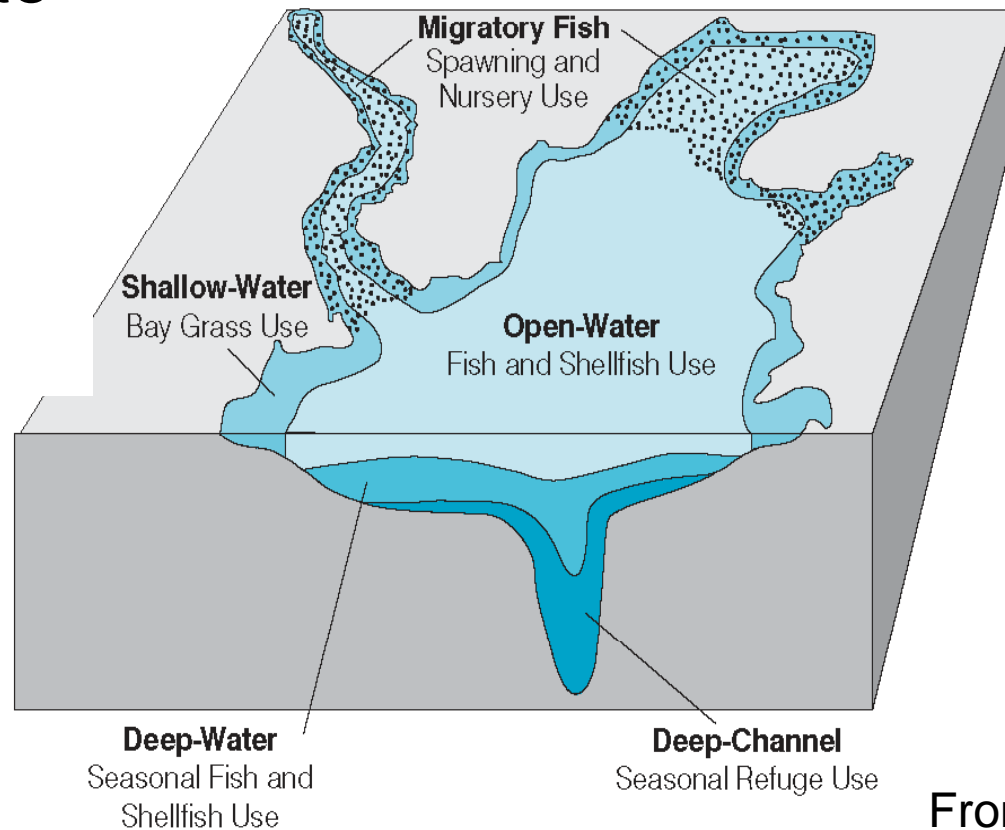


Quantifiable water quality standards of clarity/SAV and open water DO are designed to protect SAV and shallow water living resources.

A. Cross-Section of Chesapeake Bay or Tidal Tributary



B. Oblique View of the Chesapeake Bay and its Tidal Tributaries



From Batiuk (2003)



VA Water Quality Standards for Clarity/SAV

B. Submerged Aquatic Vegetation and Water Clarity

If the submerged aquatic vegetation (SAV) acres in this subsection are met in any individual Chesapeake Bay Program segment as described in subsection D of this section, then the shallow-water submerged aquatic vegetation use is met in that segment. If the SAV acres in this subsection are not met in any individual Chesapeake Bay Program segment, then the water clarity criteria shall apply to the water clarity acres in that segment. If these water clarity criteria are met to the bottom water-sediment interface for the number of water clarity acres in that segment, then the shallow-water submerged aquatic vegetation use is met; regardless of the number of acres of SAV in that segment.

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<u>Designated Use</u>	<u>Chesapeake Bay Program Segment</u>	<u>SAV Acres¹</u>	<u>Water Clarity Criteria (percent light-through-water)²</u>	<u>Water Clarity Acres</u>	<u>Temporal Application</u>
Shallow-Water Submerged Aquatic Vegetation Use	CB5MH	7,633	22%	14,514	April 1 - October 31
	CB6PH	1,267	22%	3,168	March 1 - November 30
	CB7PH	15,107	22%	34,085	March 1 - November 30
	CB8PH	11	22%	28	March 1 - November 30
	POTTF	2,093	13%	5,233	April 1 - October 31
	POTOH	1,503	13%	3,758	April 1 - October 31
	POTMH	4,250	22%	10,625	April 1 - October 31
	RPPTF	66	13%	165	April 1 - October 31
	RPOH	0	-	0	-
	RPPMH	1700	22%	5000	April 1 - October 31
	CRRMH	768	22%	1,920	April 1 - October 31
	PIAMH	3,479	22%	8,014	April 1 - October 31
	MPNTF	85	13%	213	April 1 - October 31
	MPNOH	0	-	0	-
	PMKTF	187	13%	468	April 1 - October 31
	PMKOH	0	-	0	-
	YRKMH	239	22%	598	April 1 - October 31
	YRKPH	2,793	22%	6,982	March 1 - November 30
	MOBPH	15,901	22%	33,990	March 1 - November 30
	JMSTF2	200	13%	500	April 1 - October 31
	JMSTF1	1000	13%	2500	April 1 - October 31
	APPTF	379	13%	948	April 1 - October 31
	JMSOH	15	13%	38	April 1 - October 31
	CHKOH	535	13%	1,338	April 1 - October 31
	JMSMH	200	22%	500	April 1 - October 31
	JMSPH	300	22%	750	March 1 - November 30
	WBEMH	0	-	0	-
	SBEMH	0	-	0	-
	EBEMH	0	-	0	-
	LAFMH	0	-	0	-
ELIPH	0	-	0	-	
LYNPH	107	22%	268	March 1 - November 30	
POCOH	0	-	0	-	
POCMH	4,066	22%	9,368	April 1 - October 31	
TANMH	13,579	22%	22,064	April 1 - October 31	

¹ = The assessment period for SAV and water clarity acres shall be the single best year in the most recent three consecutive years. When three consecutive years of data are not available, a minimum of three years within the most recent five years shall be used.



We hear you!

Friedrichs, M., C. Cerco, C. Friedrichs, R. Hood, D. Jasinski, W. Long, K. Sellner, G. Shenk. (2011). *Chesapeake Bay Hydrodynamic Modeling: A Workshop Report* (CRC# STAC 11-04). STAC.

http://www.chesapeake.org/pubs/257_Friedrichs2011.pdf

Use multiple models.

Use open source community models.

All present and future CBP models should be able to be openly and quantitatively assessed by the scientific community.

“Modularize” both present CBP models and other models that may be adopted by the CBP in the future. The modularized components could then be easily interchanged within a community-supported testbed by modelers both inside and outside CBP. In this fashion, various ensembles of watershed, hydrodynamic, water quality and other models could be more easily compared and tested.

Form a Chesapeake Modeling Laboratory



...and we hear you too Chris....

Pyke, C. (2012). *STAC Letter to Chesapeake Bay Program Management Board re: Multiple Models January, 2012*. STAC.

http://www.chesapeake.org/pubs/283_ChrisPyke2012.pdf

Future hydrodynamic/water quality models should be selected through quantitative skill assessment and an independent peer review process

A portion of EPA modeling funds should be directed each year to the modeling community to develop and run multiple hydrodynamic/water quality models.

Implement a prototype multiple modeling strategy involving both skill assessment and peer review for the identification of models that best match observations in this shallow <3 m border of the tidal Chesapeake Bay and its tributaries.



Where we are in the Partnership

The CBP Partners are just now drafting guiding principles – We can't get in front of partnership decisions.

“Leading up to 2017, the Partnership committed to conduct a **midpoint assessment to review our progress toward meeting the nutrient and sediment pollutant load reductions** identified in the 2010 TMDL and Phase I and Phase II Watershed Implementation Plans (WIPs). This was designed as **a mid-course check on progress that takes stock of the latest science, data, progress, and the range of available tools and controls.** This information would inform necessary adjustments in strategies, including the Phase III WIPs, to **ensure that the Partnership could achieve its 2025 goals for putting the necessary practices in place to restore the Bay.**”



Where we are in the Partnership (*continued*)

PRINCIPLE 1: KEEP THE FOCUS ON IMPLEMENTATION AND MAINTAIN A STABLE TRACKING PROCESS UP THROUGH THE MIDPOINT ASSESSMENT

The #1 water quality priority of the Partnership is the focused implementation of the Chesapeake Bay TMDL....

PRINCIPLE 5: PRIORITIZE MID-POINT ASSESSMENT CHANGES TO INFORM PHASE III WIPS THAT MEET WATER QUALITY STANDARDS

The Partnership recognizes the need to adaptively manage the Chesapeake Bay restoration. The Partnership will review any changes in decision-support tools, monitoring protocols, criteria assessments such as the models and methods used to determine goals and assess progress, and weigh the effects of these proposed changes against the impacts to meeting the ultimate goal of having all of the management practices on the ground by 2025 to meet water quality standards. The Partnership will carefully consider and take into account scientific, technical, financial and other implementation factors. The Partnership recognizes that this analysis will include defining the limitations in the decision support tools and working within any uncertainty to implement the 2025 goals.



Where we are in the Partnership (*continued*)

Midpoint Assessment Decision-Making Process and Schedule:

Provide clear indication of who will set priorities and make decisions.

Provide clear schedule for midpoint assessment process, including:

Submission of 2017 midpoint assessment model recommendations.

Complete initial model updates.

Calibration.

Testing period for Partners (suggest at least 6 months).

Finalize model updates.

Start using models for Phase III WIP and milestone development.

Phase III WIP development schedule contingent upon the development of tested and approved tools through the 2017 midpoint assessment.

Balance Resources for Improved Decision-Support Tools versus Implementation.

Allocation Methodology (some conflicting comments on this)

Rerun key scenarios that have informed allocations in the past, such as E3 and No Action

Revisit allocation methodology

Concern with changes in allocations and/or planning targets that would increase the level of effort necessary to meet water quality goals

Improve Transparency, Understanding, and User-Friendliness of Modeling Tools to Increase Credibility with Partners and Public:

Determine appropriate scale of the Chesapeake Bay Program (CBP) Models, taking into account the scale that Partners need and uncertainty associated with various scales.

Conduct uncertainty analysis.

Note conflicting comments on whether models should be improved to go local, or models should be focused on larger scale and spend resources on implementation instead.

Make CBP model inputs and outputs more transparent and understandable, and/or increase resources (including staff) available to explain models.

Consider use of M/V/CAST for Bay TMDL accountability, given that more understandable and easier to use than Scenario Builder and Watershed Model – note some conflicting comments

Allow local data (land use, local TMDLs, BMP implementation, land use, animal numbers, septic systems, future projections) be considered for ground-truthing or nested into CBP models.

Transition land-use change BMPs to efficiency BMPs, since easier to compare and understand

Assessing Progress:

Increasingly use monitoring information and indicators of ecosystem response when assessing progress. Note – other comments identify the need for accounting for lag time.

Update/simplify NEIEN and BayTAS to assist in tracking and accountability.

Consider use of M/V/CAST for accountability (see comment above).

Revisit “problem segments”, “other lines of evidence” for explaining attainment, and simulation of chlorophyll-a and SAV/clarity attainment.

Consider tradeoffs associated with verification, including resources for verification vs. implementation. Consider possible incremental approach for adopting verification principles.

Calibration Methods:

Use of more monitoring data.

Is this hindered by extending calibration period?

Revisit regional factors.

How will calibration account for lag times, especially associated with groundwater, that are associated with observing the benefits of BMP implementation?

Opportunity for states to resubmit historic BMPs.

Land Use Characterization and Classifications:

Improve methods for simulating current land use, animal, septic data, including incorporating local data and/or annual ag data.

Improve methods for accounting for annual change in land use, animal, septic data, including incorporating local data and/or annual ag data. Consider options for verifying change.

Improve methods for land use, animal, septic, etc projections, including incorporating local data.

Have Phase III WIPs be developed in 2025 land use and base conditions.

Improve methods for delineating federal land uses.

Increase categories of urban land uses in order to have more specific loadings associated with each (eg, low density residential should have lower loading than acre of high density urban).

Add in wetlands land use.

Treatment of BMPs within CBP Models:

Develop BMPs that address legacy sediment, including revisiting benefits of stream restoration on reduced erosion.

Revisit assumptions associated with erosion from streams.

Develop BMPs for the estuary and come up with way to credit in Watershed and/or Water Quality and Sediment Transport Models – eg, living shorelines, filter feeders, etc.

Incorporate recommendations from BMP expert panels.

Revisit BMP sequence.

Replace land use change BMPs with efficiencies (see comment in “understandability” section).

Improve backout procedures for relevant BMPs.

Allow flexibility to incorporate new technologies into modeling tools.

Manure: Revisit Assumptions Associated with Nutrient Content, Mineralization, Loss, Application.

Other Model Enhancements:

Consider impacts of extreme weather events and climate change.

Account for residual phosphorus in soils.

Consider use of multiple models, particularly in assessing tidal shallows.



2017 Midpoint Assessment Timeline

Now - Soliciting Partnership input for the Midpoint Assessment and using a working version of the Guiding Principles to begin scoping and prioritizing components of the midpoint assessment.

Winter 2013 - PSC approval of the Guiding Principles priorities finalized.

January 2013 - *STAC workshop on multiple CBP management models to explore opportunities and challenges in applying multiple models to CBP management.*

2013-2015 - Airshed Model updates planned and tracked for bi-modal NH₃ & Hg and new CMAQ scenarios. Watershed Model and WQSTM improvements as decided by CBP Partners initiated. Extension of all model simulation periods from current 1985-2005 to ~1980-2011. Value of M3 in Chesapeake shallow waters evaluated with 'proof of concept' study.

December 2015 - Fully calibrated and operational airshed, watershed, estuary, and shallow water models ready for analysis of Phase III WIPs.

2016 - Jurisdictions develop Phase III WIPs with respect to what remains to be done in the final 7 years of planning (2018 -2025) to fully achieve the Bay water quality standards.

2017 – Jurisdictions submit Phase III WIPs with 2018 - 2025 actions and controls for review and approval.



Key Points

The CBP Partnership needs to decide if we going to do anything regarding refinements to the shallow water simulation. The default is analysis of SAV and clarity in water depths of 2 m or less, and open water DO in embayments currently in place.

If CBP partnership decides to go forward with refinements to the shallow water analysis we don't know what approach we're going to use.

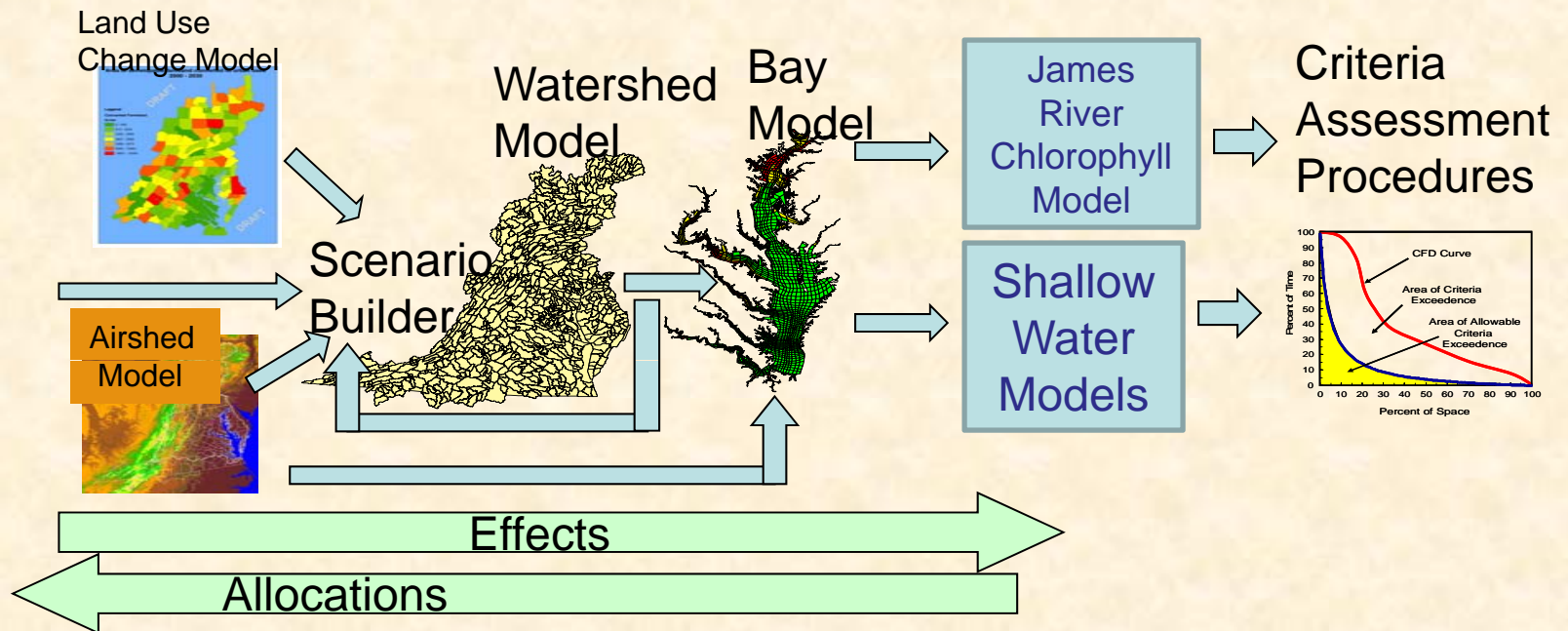
If shallow water refinements go forward we invite STAC assistance in deciding what approach to use in shallow water modeling.

We look forward to the contribution that the STAC multiple model initiative will play, which can get underway once an FY2013 budget is available, EPA funds are identified for the task, and a funding vehicle is determined. Additional assistance will come from the STAC workshop in January 2013 on how to apply multiple models in a TMDL regulatory framework.

CoE currently has funding to extend the hydrodynamic and water quality model to 2011, to examine model performance compared to the shallow water monitoring data made available by the simulation period extension, and to begin work on boundary conditions for shallow water simulations.



Operational Challenges – Keeping the End Goal in Mind



How do we do 2017 management scenarios that will influence the clarity/SAV and open water DO water quality standards? How do we do James River chlorophyll models? How do we do climate change scenarios?



Managing Expectations

- Funding for shallow water multiple models will likely come from the EPA/CBPO FY13 budget.
- Competing obligations and commitments at all levels in the FY13 budget are expected to be challenging.
- “Standoffs between the President and Congress or between political parties, elections, and more urgent legislative matters complicate the budget process, frequently making the **continuing resolution** a common occurrence in American government.” Source: Wikipedia



Managing Expectations

- A **request for proposal (RFP)**, or whatever other funding vehicle is used for the multiple shallow water models, will not be issued until funds for the task are identified. “An RFP is issued at an early stage in a procurement process, where an invitation is presented for suppliers, often through a bidding process, to submit a proposal on a specific commodity or **service.**” Source: Wikipedia



Closing Thoughts

- The CBP partnership continues to need a system of models from the airshed, watershed and estuary for the 2017 Midpoint Assessment.
- Management decision making needs of the 2017 Midpoint Assessment drives the process.
- The Bay Program State and Federal agencies represented by the WQGIT, Management Board, PSC, and other CBP workgroups implementing nutrient and sediment controls are key customers.
- We'll work with STAC on the Midpoint Assessment tools to the fullest extent possible, but meeting model delivery deadlines remains a high priority.
- CBP partners are committed to continuing to improve the accuracy, utility, and reliability of the modeling effort.